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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/981,277	10/17/2001	Janice Nickel	10991744-4	8131

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EXAMINER

LEWIS, MONICA

ART UNIT	PAPER NUMBER
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2822

DATE MAILED: 02/06/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/981,277

Applicant(s)

NICKEL, JANICE

Examiner

Monica Lewis

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 November 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 12-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 12-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 17 October 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other:

DETAILED ACTION

1. This office action is in response to the amendment filed November 25, 2002.

Response to Arguments

2. Applicant's arguments with respect to claims 12-20 have been considered but are moot in view of the new ground(s) of rejection.

Drawings

3. The drawings are objected to because it is not clear where 44 and 42 are supposed to be located because there is no line connecting the reference numerals to the drawing (See Figure 2). A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Objections

4. Claims 13 and 19 objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

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6. Claims 17-20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. It is not clear what is meant by the following: a) "word lines extending memory cell" (See Claim 17). Claims 18-20, depend directly or indirectly from a rejected claim and are, therefore, also rejected under 35 U.S.C. 112, second paragraph for the reasons set above.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 12 and 16 are rejected under 35 U.S.C. 103(a) as obvious over Gallagher et al. (U.S. Patent No. 5,640,343) in view of Daughton et al. (U.S. Patent No. 6,072,382).

In regards to claim 12, Gallagher et al. ("Gallagher") discloses the following:

- a) a bottom ferromagnetic layer (16) (See Figure 1b);
- b) an insulating tunnel barrier (22) atop the bottom ferromagnetic layer (See Figure 1b); and
- c) a top ferromagnetic layer (24) atop the insulating tunnel barrier (See Figure 1b).

In regards to claim 12, Gallagher fails to disclose the following:

- a) the bottom ferromagnetic layer having flattened peaks.

However, Daughton et al. ("Daughton") discloses the use of layers that have been flattened (See Column 7 Lines 36-57 and Column 9 Lines 38-65). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Gallagher to include the use of layers that have been flattened as disclosed in Daughton because they aid in providing a high quality barrier layer (See Column 9 Lines 38-65).

Additionally, since Gallagher and Daughton are both from the same field of endeavor, the purpose disclosed by Daughton would have been recognized in the pertinent art of Gallagher.

In regards to claim 16, Gallagher discloses the following:

- a) the top and bottom layers are AF coupled (See Column 5 Lines 6-11).

In regards to claim 16, Gallagher fails to disclose the following:

- a) the peaks are flattened to tune the AF coupling to a desired level.

However, Daughton discloses the use of layers that have been flattened (See Column 7 Lines 36-57 and Column 9 Lines 38-65). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Gallagher to include the use of layers that have been flattened as disclosed in Daughton because they aid in providing a high quality barrier layer (See Column 9 Lines 38-65).

Additionally, since Gallagher and Daughton are both from the same field of endeavor, the purpose disclosed by Daughton would have been recognized in the pertinent art of Gallagher.

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9. Claim 13 is rejected under 35 U.S.C. 103(a) as obvious over Gallagher et al. (U.S. Patent No. 5,640,343) in view of Daughton et al. (U.S. Patent No. 6,072,382) and Inomata et al. (U.S. Patent No. 6,069,820).

In regards to claim 13, Gallagher fails to disclose the following:

a) angle from the top of a grain to an intersection with an adjacent grain is between about three and six degrees.

However, Inomata et al. ("Inomata") discloses adjacent ferromagnetic grains (18) with an angle between about 3-6 degrees (See Figure 6). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Gallagher to include adjacent ferromagnetic grains with an angle between about 3-6 degrees as disclosed in Inomata because it aids in providing energy levels that are in quantization (See Column 10 Lines 13-23).

Additionally, the applicant has not established the critical nature of the angle from the top of a grain to an intersection with an adjacent grain is between about three and six degrees. "The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range." *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir.1990).

Finally, since Gallagher and Inomata are both from the same field of endeavor, the purpose disclosed by Inomata would have been recognized in the pertinent art of Gallagher.

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10. Claim 14 is rejected under 35 U.S.C. 103(a) as obvious over Gallagher et al. (U.S. Patent No. 5,640,343) in view of Daughton et al. (U.S. Patent No. 6,072,382) and Anthony (European Patent No. EP0929110A1).

In regards to claim 14, Gallagher fails to disclose the following:

a) the flattened peaks.

However, Daughton discloses the use of layers that have been flattened (See Column 7 Lines 36-57 and Column 9 Lines 38-65). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Gallagher to include the use of layers that have been flattened as disclosed in Daughton because they aid in providing a high quality barrier layer (See Column 9 Lines 38-65).

Additionally, since Gallagher and Daughton are both from the same field of endeavor, the purpose disclosed by Daughton would have been recognized in the pertinent art of Gallagher.

b) valley to height difference of no more than about one nanometer.

However, Anthony discloses the use of ferromagnetic materials with a thickness of no more than about one nanometer (See Paragraph 39). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Gallagher to include the use ferromagnetic materials with a thickness of no more than about one nanometer as disclosed in Anthony because it aids in enhancing the magneto-resistance (See Paragraph 39).

Additionally, the applicant has not established the critical nature of the valley to height difference of no more than about one nanometer. "The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within

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the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range.” *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir.1990).

Finally, since Gallagher and Anthony are both from the same field of endeavor, the purpose disclosed by Anthony would have been recognized in the pertinent art of Gallagher.

11. Claim 15 is rejected under 35 U.S.C. 103(a) as obvious over Gallagher et al. (U.S. Patent No. 5,640,343) in view of Daughton et al. (U.S. Patent No. 6,072,382) and Chen et al. (U.S. Patent No. 5,953,248).

In regards to claim 15, Gallagher fails to disclose the following:

a) the junction has a resistance of less than about $10\text{ K}\Omega\text{-}\mu\text{m}^2$.

However, Chen et al. (“Chen”) discloses a junction resistance of 10 kohms (See Column 4 Lines 38-43). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Gallagher to include a junction resistance of 10 kohms as disclosed in Chen because it aids in enabling current to flow through the layer (See Column 4 Lines 34-43).

Additionally, the applicant has not established the critical nature of the resistance of less than about $10\text{ K}\Omega\text{-}\mu\text{m}^2$. “The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range.” *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir.1990).

Finally, since Gallagher and Chen are both from the same field of endeavor, the purpose disclosed by Chen would have been recognized in the pertinent art of Gallagher.

12. Claims 17 and 18, as far as understood, are rejected under 35 U.S.C. 103(a) as obvious over Gallagher et al. (U.S. Patent No. 5,640,343) in view of Anthony (European Patent No. EP0929110A1).

In regards to claim 17, Gallagher discloses the following:

a) an array of memory cells (9), each memory cell including an SDT junction, each SDT junction including a bottom ferromagnetic layer, each bottom ferromagnetic layer having an upper surface (See Figure 1a and Figure 1b);

b) a plurality of word lines (1, 2 and 3) extending memory cell rows of the array (See Figure 1a); and

c) a plurality of bit lines (4, 5 and 6) extending along memory cell columns of the array (See Figure 1a).

In regards to claim 17, Gallagher fails to disclose the following:

a) each upper surface having a valley-to-peak height variation of no more than about one nanometer.

However, Anthony discloses the use of ferromagnetic materials with a thickness of no more than about one nanometer (See Paragraph 39). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Gallagher to include the use ferromagnetic materials with a thickness of no more than about one nanometer as disclosed in Anthony because it aids in enhancing the magneto-resistance (See Paragraph 39).

Additionally, the applicant has not established the critical nature of the valley-to-peak height difference of no more than about one nanometer. "The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable

within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range.” *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir.1990).

Finally, since Gallagher and Anthony are both from the same field of endeavor, the purpose disclosed by Anthony would have been recognized in the pertinent art of Gallagher.

In regards to claim 18, Gallagher discloses the following:

a) resistance variation of the junctions across the entire array is no more than about 4% (See Column 6 Lines 29-32).

Additionally, the applicant has not established the critical nature of the resistance variation of the junctions across the entire array is no more than about 4%. “The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range.” *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir.1990).

13. Claim 19, as far as understood, is rejected under 35 U.S.C. 103(a) as obvious over Gallagher et al. (U.S. Patent No. 5,640,343) in view of Anthony (European Patent No. EP0929110A1) and Inomata et al. (U.S. Patent No. 6,069,820).

In regards to claim 19, Gallagher fails to disclose the following:

a) angle from the top of a grain to an intersection with an adjacent grain is between about three and six degrees.

However, Inomata discloses adjacent ferromagnetic grains with an angle between about 3-6 degrees (See Figure 6). It would have been obvious to one having ordinary skill in the art at

the time the invention was made to modify the semiconductor device of Gallagher to include adjacent ferromagnetic grains with an angle between about 3-6 degrees as disclosed in Inomata because it aids in providing energy levels that are in quantization (See Column 10 Lines 13-23).

Additionally, the applicant has not established the critical nature of the angle from the top of a grain to an intersection with an adjacent grain is between about three and six degrees. "The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range." *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir.1990).

Finally, since Gallagher and Inomata are both from the same field of endeavor, the purpose disclosed by Inomata would have been recognized in the pertinent art of Gallagher.

14. Claim 20, as far as understood, is rejected under 35 U.S.C. 103(a) as obvious over Gallagher et al. (U.S. Patent No. 5,640,343) in view of Anthony (European Patent No. EP0929110A1) and Chen et al. (U.S. Patent No. 5,953,248).

In regards to claim 20, Gallagher fails to disclose the following:

a) the junction has a resistance of less than about $10 \text{ K}\Omega\text{-}\mu\text{m}^2$.

However, Chen discloses a junction resistance of 10 kohms (See Column 4 Lines 38-43). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Gallagher to include a junction resistance of 10 kohms as disclosed in Chen because it aids in providing current to flow through the layer (See Column 4 Lines 34-43).

Additionally, the applicant has not established the critical nature of the resistance of less than about $10\text{ K}\Omega\text{-}\mu\text{m}^2$. "The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range." *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir.1990).

Finally, since Gallagher and Chen are both from the same field of endeavor, the purpose disclosed by Chen would have been recognized in the pertinent art of Gallagher.

Conclusion

15. The following prior art made of record and not relied upon is considered pertinent to applicant's disclosure: a) Fuke et al. (U.S. Patent No. 5,976,713) discloses magnetic resistance; b) Sato et al. (U.S. Patent No. 5,986,858) discloses ferromagnetic tunnel junction; c) Coffey et al. (U.S. Patent No. 6,016,241) discloses a magnetoresistive sensor; d) Abraham et al. (European Patent No. EP0936622A2) discloses a magnetic memory device; and k) Schwabe et al. (PCT Publication No. WO 00/26918) discloses a magnetic storage device.

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Monica Lewis whose telephone number is 703-305-3743.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on 703-308-4905. The fax phone number for the organization where this application or proceeding is assigned is 703-308-7722 for regular and after final

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communications. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

ML

January 31, 2003



AMIR ZARABIAN
SUPERVISORY PATENT EXAMINER
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